

HIGHER YIELD WITH LESS EXPENSES - INVESTIGATION OF HETEROISIS-EFFECT ON OWN DOUBLE-ZERO WINTER RAPE MATERIAL.

H. BUSCH

Deutsche Saatveredelung Lippstadt-Bremen GmbH, Weissenburger Straße 5,
59557 Lippstadt, Germany

ABSTRACT

19 rapeseed lines and 20 composit- and restored hybrids made from these lines were investigated for different yield parameters. This investigation was made by counting and measuring on single plants grown in plots with normal plant density. Besides of this the plots were scored for important agronomic characters.

The hybrids showed an increase between 10- and 63% in all morphological characters compared to the normal lines. The scores of the plots showed that especially the composit hybrids possess a very high regeneration- and compensation ability.

INTRODUCTION

With the introduction of earlier and shorter varieties in the beginning of the nineties the breeders succeeded in creating varieties which yielded better under continental climate conditions in the middle- and eastern Europe. These varieties do also have a more efficient utilization of nitrogen compared to the taller maritime types, which were grown in the eighties. This can be seen on the results from the official trials in Germany in the period 1971-1993, where yield is related to application of nitrogen (Fig 1.). A further improvement in that direction may be achieved by the breeding of hybrids.

For the breeding of hybrids it is necessary, through backcrossing, to incorporate cytoplasmatic male sterility (CMS) in the female partner, and restauration ability in the male partner of the hybrids. In addition to this hybridpartners which are genetically very different, but at the same time posses a good combination ability, have to be found in order to obtain a high heterosis effect in the hybrid. At the moment the breeders have a high number of CMS-lines available in advanced back crossing generations which are suitable for use as female hybrid partners. Opposite to that, the development of good restorer lines seems to be more difficult.

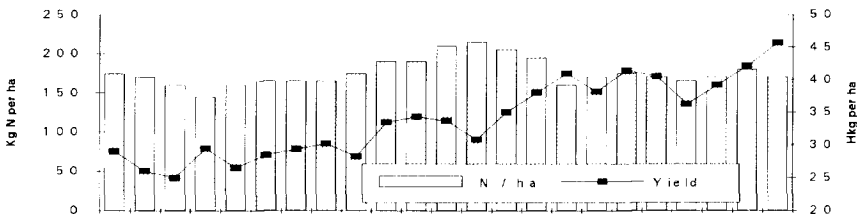


Figure 1:Yield related to nitrogen application in the German official trials 1971-93 (Bundessortenamt Hannover, 1994).

EXPERIMENTAL

The aim of the project was to investigate, which morphological characters were having the largest influence on the higher yield and vigour of hybrids in comparison to normal lines. The work was carried out on own breeding material. Composit hybrids and restored hybrids were investigated separately in these trials. Countings, measurements and scorings were made on ten single plants from each genotype grown in plots with a normal plant density. The plots were harvested to obtain yield and quality data of the genotypes. The results of the composit hybrids are shown in table 1 and 2.

Table 1: Morphological characters of ten composit hybrids and their parental lines in trials 1994.

	Height after flowering	Stem thickness	Number of sidebranch.	Pods on flowering	Pods on 1 st sidebranch
Av. 8 Parental lines	168 cm	1,30 cm	11,0	56,4	21,1
Av. 10 Comp. hybs	184 cm	1,57 cm	12,4	64,4	27,8
Increase in pct.	10	21	13	14	13

Table 2: Yield, oil content and important agronomic characters of ten composit hybrids and their parental lines in trials 1994.

	Yield relative	Oil-content	Growth Autumn	Growth Spring	Lod-ging	Suscept. diseases	Disease maturity
Av. 8 parental lines	103	44,3 %	6,4	5,3	6,5	6,5	5,3
Av. 10 comp. hybs.	127	45,2 %	7,0	5,7	6,2	5,5	5,9
Increase pct / score	23	2	0,6	0,4	-0,3	-1,0	0,6

* = \emptyset standard varieties LIRAJET, Falcon, IDOL und BRISTOL = 100

** = score table 1-9; 9 = pos. development; 1 = neg. development of the conc. features

1. All the investigated morphological characters are shown to a higher extent in the composit hybrids compared to the parental lines. This is also reflected in an average yield increase of 23 percent.
2. The increased plant height makes it possible for the hybrids to produce more yield active green matter. This can be seen from a higher number of sidebranches and pods developed on the hybrids.
3. The plants show a good lodging resistance despite of the longer stems. This seems to indicate that the anatomy of the plants is not negatively influenced.
4. From the scores for plant development before and after winter it can be seen that the hybrids in general develop faster in the autumn and in the early spring. This gives the plants an advantage in the development of yield parameters.
5. Opposite to that the complex scoring for diseases before harvest (attack from phoma and verticillium) showed a 0,6 point better note for the hybrids. This shows that the

combination effects in the hybrids can have a positive effect on these important diseases

6. The oil content of the hybrids was in average 1 percent higher than in the parental lines. This indicates that an improvement of that character can be made by hybrid breeding.

Table 3: Morphological characters of 10 restored hybrids and their parental lines

	Height after flowering	Stem thickness	Number of sidebranch.	Pods on flowering	Pods on 1 st sidebranch
Av. 11 Parental lines	165 cm	1,39 cm	10,6	57,2	23,2
Av. 10 Rest. hybrids	196 cm	1,54 cm	12,1	66,4	37,7
Increase in pct.	19	11	14	16	63

Table 4: Yield , oil content and important characters of ten composit hybrids and their parental lines in trials 1994

	Yield relative	Oil- content	Growth Autumn	Growth Spring	Lod- ging	Suscept. diseases	Disease maturity
Av. 11 parental lines	102	44,5 %	6,4	5,3	6,3	6,4	5,9
Av. 10 rest. hybrids.	117	44,8 %	6,4	5,0	7,3	5,4	6,3
Increase pct / score	15	1	0	-0,3	1,0	-1,0	0,4

* = ∅ standard varieties LIRAJET, Falcon, IDOL und BRISTOL = 100

** = score table 1-9; 9 = pos. development; 1 = neg. development of the conc. features

The results from the trials with the restored hybrids show in general the same trends as the composit hybrids, but the following specific points are to be mentioned:

1. The increase in plant height without influence on lodging, was shown to a higher extent by the restored hybrids.
2. The number of pods on the first level of sidebranches shows an average of 37.7 on the hybrids compared to 23.2 by the parental lines.
3. Despite of a relatively poor scoring for plant development before winter, the hybrids have given a yield increase of 15%. Therefore, there seems to be a very high regeneration- and compensation ability in the restored hybrids.

CONCLUSION

The results from this project show that it will be possible in the near future to produce restored hybrids which are more vigorous and higher yielded than the line varieties available on the market today. It is however important to say that the crossing of a CMS-line with a restorer line doesn't itself create a hybrid effect causing a higher yield. The crucial point in the development of high yielding hybrids with good agronomic traits will be to find parental lines which combine well.